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The net plankton of Nesslin Lake

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INTRODUCTION

An investigation of the plankton of Nesslin Lake, Saskatchewan, was carried out with a view to gaining further insight into the productivity and general ecology of the lake. Nesslin Lake is situated about 13 miles north east of the town of Big River, just outside the west boundary of Prince Albert National Park, in Township 57, Range 6 west of the third meridian. The field work was done during the summer of 1950 and the laboratory analysis was carried out in the ensuing fall and winter. The work on plankton was done in conjunction with an investigation in the lake of Triaenophorus crassus, the pike-whitefish tapeworm, under the joint auspices of the Fisheries Research Board of the Dominion Department of Fisheries, and the Fisheries Branch of the Saskatchewan Department of Natural Resources and Industrial Development.

A BRIEF DESCRIPTION OF THE LAKE

Nesslin Lake is situated in the mixed-wood section of the northern coniferous forest in the Canadian life zone. White spruce aspen poplar, and birch are the most abundant forest trees, while the land abounds in timber wolves, elk, mule deer, and ruffed grouse. The country is rolling with a gentle dip to the north west from the Bluebell Watershed, the height of land between the Saskatchewan and Churchill drainage systems, to the Beaver River. There was formerly much more water in the area than now, lakes that are now quite isolated draining freely into one another. The lake it-

self is small, measuring only three miles by one and a half, and having an area of 2.3 square miles. Its shape is roughly that of an hour glass, and lying in a north-south direction. The maximum observed depth is 35 meters, with a calculated mean depth of 13.2 meters.

METHODS

The plankton samples, except the first, were taken at a point midway in the narrowest portion of the lake at a depth of 34 meters, while the first was taken at a point closer to the west shore at a depth of 26 meters. In all, eleven pairs of duplicate total vertical hauls were taken between 22 May and 26 August using a Wisconsin type plankton net of #20 silk bolting cloth and a mouth diameter of 25 centimeters.

In the laboratory the samples were analyzed volumetrically, gravimetrically, and by counting. In the volumetric determinations, the plankton was allowed to settle for 48 hours in a 10 cc. graduate cylinder of 1 cm. diameter before a reading was taken, after which it was evaporated and dried in an oven at 60° C. for 72 hours, using a 15 cc. crucible. Ashing, to determine the weight of organic matter present, was done over the reducing flame of the Bunsen for 30 minutes.

In doing the counts, twelve genera of zooplankters were enumerated, and a rough estimate of the abundance of a thirteenth was recorded. Counts were made by concentrating the sample to 50

or 20 cc. and transferring a 1 cc. sample to a counting cell by means of a Stempel pipette. No counts were made of any phytoplankters.

RESULTS

In order to make the results comparable with those from other lakes, the dry weights and organic weights were calculated on a basis of area and volume, in the manner used by Rawson ('42). The dry weight is expressed in kilograms per hectare after allowing for an efficiency in straining of 22%, using a net mouth area of 490 square centimeters. Thus, the amount in milligrams per total vertical haul multiplied by 0.916 gives the amount in kilograms per hectare. To obtain the dry and organic weights in milligrams per cubic meter, the actual weights were divided by the number of cubic meters of water strained. Table 1 shows the actual and calculated amounts of plankton. It was found that the average dry weight was 53.9 kg./ha. or 175.6 mg./m^3., while the weight of organic matter was 101.6 mg./m^3. These values are expressed graphically in Graphs 1, 2, 3, and 4. Number 1 shows the weekly variation in dry weight in kg./ha. This curve follows the same pattern as that in Number 2 where the dry weight is expressed in mg./m^3. It will be noted that Nesslin Lake has its riches supply of plankton during the month of June, with a second slighter pulse in the latter half of July. It will also be noted that the curve for the weight of organic matter follows that for dry weight very closely.

Graph 3 shows the percent ash and the volume in cc. -- very irregular curves in comparison with the previous ones. The extreme variation in the percent ash during July and August may be due to errors in the determinations. Otherwise, it is not known what significance the fluctuations may bear. There is fair correlation, however, between the volume and the dry weight, as is shown in Graph 4. In general, the plankton became leaner toward the end of August.

The results of the counting are shown in Table 2 in a slightly altered form. The twelve genera that have been counted were:

Cyclops	Daphnia	Ceratium
Diaptomus	Keratella	Polyarthra
Nauplius	Notholca	Triarthra
Bosmina	Conochilus	Asplanchna

The abundance of Dinobryon was only estimated. The values are expressed as number of individuals per liter of water. The relative numbers of the various genera can be better visualised by referring to Graphs 5 and 6, where the number of individuals per liter are plotted on semi-logarithmic paper for the period of observation. This plotting on a logarithmic scale should be borne in mind when noring the peaks and depressions, as the peaks are somewhat diminished, and the depressions augmented to a startling degree. It should also be mentioned that Peridinium was present in considerable numbers in the sample taken on 25 July.

TABLE I -- ACTUAL AND CALCULATED DATA FROM ANALYSIS OF PLANKTON

DATE OF SAMPLE	VOLUME cc	DRY WT. mg	WT. OF ASH mg	WT. OF ORG MATTER mg	% ASH	DRY WT. kg/ha	DRY WT. mg/m^3	WT. OF ORG MATTER mg
22 May 1950	0.6	23.2	5.9	17.3	25.4	21.3	90.9	67.7
10 June 1950	3.4	96.6	47.5	49.1	49.2	88.3	286.0	145.2
16 June 1950	3.0	84.5	44.4	40.1	52.5	77.3	250.0	118.6
24 June 1950	3.65	103.0	48.7	54.3	47.2	94.5	305.0	161.0
6 July 1950	2.9	69.4	28.7	40.7	41.3	63.6	205.0	120.3
11 July 1950	2.75	71.2	24.0	47.2	33.7	65.2	211.0	139.1
17 July 1950	2.2	37.2	15.9	21.3	42.8	33.5	110.0	63.1
25 July 1950	3.0	51.9	14.3	27.6	27.5	47.6	153.8	81.7
10 Aug. 1950	1.8	39.8	16.4	23.4	41.2	36.4	117.8	69.3
17 Aug. 1950	1.4	30.4	5.3	25.1	17.4	27.8	90.0	74.3
26 Aug. 1950	1.1	41.1	15.2	25.9	37.0	37.6	121.7	76.7
Averages	2.35	58.9	24.2	33.8	37.7	53.9	175.6	101.6

GRAPH 1 -- VARIATION IN DRY WEIGHT KG/HA DURING THE TIDE OF SAMPLING

GRAPH 2 -- VARIATION IN DRY WEIGHT AS COMPARED WITH WEIGHT OF ORGANIC MATTER

GRAPH 3 -- VARIATION IN PER CENT ASH AND VOLUME DURING THE SAMPLING PERIOD

GRAPH 4 -- THE RELATIONSHIP OF DRY WEIGHT (MGM) TO VOLUME (CC.)

COMPARISON WITH OTHER LAKES

In order to evaluate the plankton crop of Nesslin Lake, the results might be compared with those obtained from other lakes. For this purpose, six alpine lakes have been chosen for which similar data are available (Rawson '42). Also, certain figures for Lake Waskesiu, Lake Athabaska, and Great Slave Lake (Rawson '47) are included. This data will be found in Table 3 along with the data from the Nesslin Lake samples. For more rapid comparison, Graph 7 shows Nesslin Lake compared with the six alpine lakes.

It may be seen that Nesslin Lake closely resembles Paul Lake, British Columbia. And, although Waskesiu is separated by only some 15 miles from Nesslin (and thus has a similar climate) it is much richer than Nesslin, indicating, perhaps, some greater tendencies to eutrophy. The other lakes with which a comparison is made are all much leaner in plankton crop, and might be considered oligotrophic in this regard.

CONCLUSIONS

Bringing together all the available data, it can be said that the plankton of Nesslin Lake indicates a moderately eutrophic condition. Of the twelve genera counted, the most abundant rotifer was Keratella, and the most abundant crustacean, Cyclops. The protozoan, Ceratium hirundinella, was present in very great numbers.

Table II. -- Plankton counts: number of individuals per litre of water for twelve genera.

Species	May 22	June 10	June 16	June 24	July 6	July 11	July 17	July 25	Aug. 10	Aug. 17	Aug. 26	Averages
Cyclops	1.0	2.3	3.5	7.1	3.2	2.6	2.7	3.5	1.8	1.8	1.2	2.8
Nauplius	1.5	1.1	2.1	9.2	2.7	4.8	3.9	1.6	0.9	0.9	0.4	2.6
Diaptomus	0.2	0.2	0.2	3.7	0.3	1.0	0.4	0.6	0.6	0.6	0.2	0.7
Bosmina	0.1	0.1	0.3	4.5	3.0	4.4	3.3	4.0	2.1	0.9	0.4	2.1
Daphnia	0.1	+	0.1	0.6	0.2	0.3	0.6	2.0	1.5	1.0	1.0	0.7
Keratella	3.4	10.7	9.9	56.8	20.8	68.5	10.5	10.3	5.6	2.0	1.8	18.2
Notholca	2.7	1.7	4.0	39.7	18.0	38.8	15.1	11.3	2.3	2.0	0.8	12.4
Conochilus	---	---	1.9	3.3	2.0	5.7	1.5	0.7	0.1	0.2	0.2	1.7
Ceratium	0.5	0.3	0.8	47.3	13.1	130.6	36.7	4.3	41.9	130.0	92.6	57.2
Polyarthra	0.3	---	0.2	8.3	2.0	10.8	0.7	0.2	---	+	+	3.2
Triarthra	0.4	0.2	0.2	1.5	0.8	2.7	0.9	0.3	---	0.2	0.2	0.7
Asplanchna	2.2	1.1	0.2	0.5	0.1	0.2	0.2	0	0.5	+	+	0.5
Dinobryon	+++	++	++++	++++	+++	++	+	+++	++	+	+	++

GRAPH 5 -- THE RELATIVE ABUNDANCE OF THE VARIOUS GENERA EXPRESSED AS THE NUMBER OF INDIVIDUALS PER LITRE OF WATER

GRAPH 6 -- THE RELATIVE ABUNDANCE OF THE VARIOUS GENERA EXPRESSED AS THE NUMBER OF INDIVIDUALS PER LITRE OF WATER

Can it be said that the plankton is sufficient to support a normal fish population? If we compare the data with that for other lakes, e.g. Maligne, Waterton, or Minnewanka, and see how these lakes have supported reasonably large fish populations (Rawson '42), it can be safely concluded that the moderately rich plankton in Nesslin is ample for sport, and even small commercial, populations of fish. Nesslin, of course, is too small to withstand a great amount of fishing, but it is important to the mink rancher who uses fish as a main item of diet for his animals.

It would appear, then, that Nesslin Lake, being slightly eutrophic, has a rich enough plankton crop to support a normal fish population.

SUMMARY

1. The plankton of Nesslin Lake, Saskatchewan, was investigated in the summer of 1950 in conjunction with the Triaenophorus studies of the Fisheries Research Board.
2. The situation and surroundings of Nesslin are described, the lake having an area of 2.3 square miles and a mean depth of 13.2 meters.
3. The location of the stations are described; eleven pairs of duplicate total vertical hauls were taken with a Wisconsin type plankton net. Volumetric and gravimentric analysis, and counts of twelve representative genera were carried out at the University laboratory.

Table III -- Data for comparison of Nesslin with other lakes.

Lake	No. of samples	Volume cc.	Dry weight mg.	Wt. of org matter mg.	Dry weight kg/ha	Dry weight mg/m^3	Wt. of org matter mg/m^3
Nesslin	11	2.35	58.9	33.8	53.9	175.6	101.6
Paul	7	4.18	54.8	46.2	50.2	122.5	103.0
Bow	5	0.29	13.0	8.7	11.9	29.3	20.1
Waterton	7	0.70	21.0	14.7	19.2	21.5	14.9
Minnewanka	6	1.34	35.0	28.0	32.0	39.9	31.9
Maligne	6	0.67	22.5	14.0	20.6	27.8	23.5
Okanagan	11	1.40	28.4	19.8	26.0	26.0	18.0
Athabaska (deep)	--	--	40.0	--	--	--	--
Athabaska (shallow)	--	--	20.5	--	--	--	--
Great Slave	--	--	32.0	--	--	--	--
Waskesiu	5	3.20	68.6	22.8	62.8	349.0	116.1

GRAPH 7 -- PLANKTON CROP OF NESSLIN LAKE
COMPARED WITH OTHER LAKES

4. The results are recorded in Tables 1 - 3 and in Graphs 1 - 7. It is noted that the average dry weight in kg./ha. is 53.9, the average dry weight in mg./m^3., 175.6, and the average weight of organic matter in mg./m^3., 101.6. The average volume is 2.35 cc.
5. The data from Nesslin Lake are compared with the data from other selected lakes, and it is shown that Nesslin is as rich as Paul Lake, British Columbia, but somewhat leaner than Lake Waskesiu, Saskatchewan.
6. Nesslin Lake is somewhat eutrophic by virtue of its plankton crop, whose most abundant genera are: Cyclops, Keratella, and Ceratium. Nesslin Lake has a rich enough plankton crop to support a normal fish population for a lake of its size.

LITERATURE CITED

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